

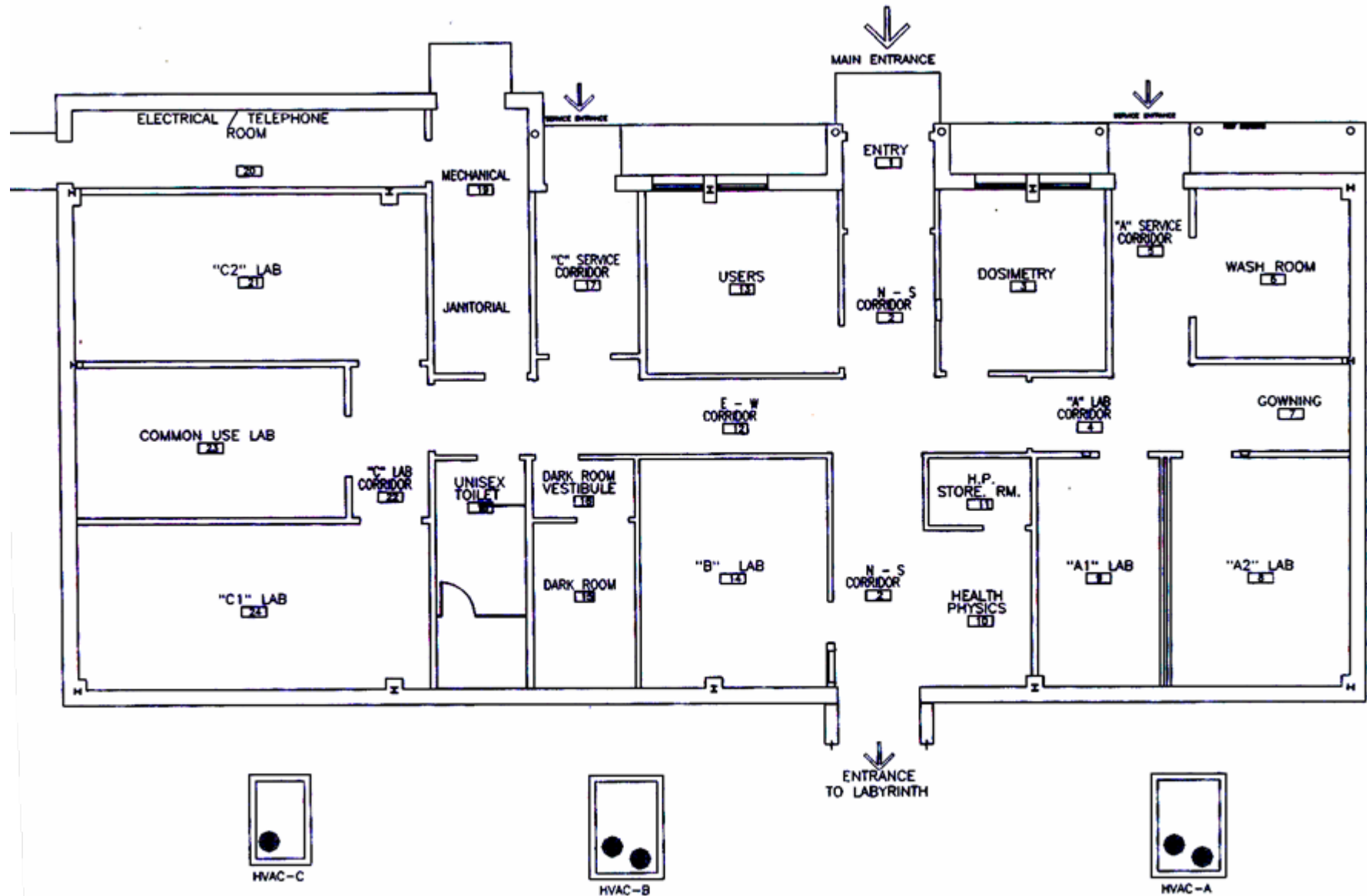
C-AD Radiobiology User Training



NSRL Experimental Support Building (Bldg 958)



NSRL Experimental Support Building (Bldg 958)



C-A Conduct of Operations

- Written procedures exist for most operations
- Use of qualified and trained personnel
- Appropriate authorizations and work permits before starting a job or operations
- Definitive lines of authority:

On-duty Operations Coordinator (x4662) is responsible for safe operation of accelerator complex during operating periods

Maintenance Coordinator is responsible for safe operation and coordination during shut down periods

C-AD Contacts

Liaison Physicist

Adam Rusek 5830

Liaison Engineer

Dave Phillips 4671

Required Training

Minimum for all Radiobiology Users:

Minimum training required for access to NSRL Target Room (and for access to Bldg 912 experimental areas):

- BNL Radiation Worker
- C-AD Radiobiology User Training

Examples of other training requirements that may be required (depending on your work activities):

- Lab Standard
- Hazardous Waste Generator
- Regulated Medical Waste Generator
- Bloodborne Pathogens Awareness
- Dispersible On-the-Job Training (OJT) demonstration
- Radioactive Waste Generator
- Cryogen Safety Training
- Compressed Gas

ACCESS CONTROL SYSTEM

Question: Why Designed?

Answer: To protect people from radiation hazards

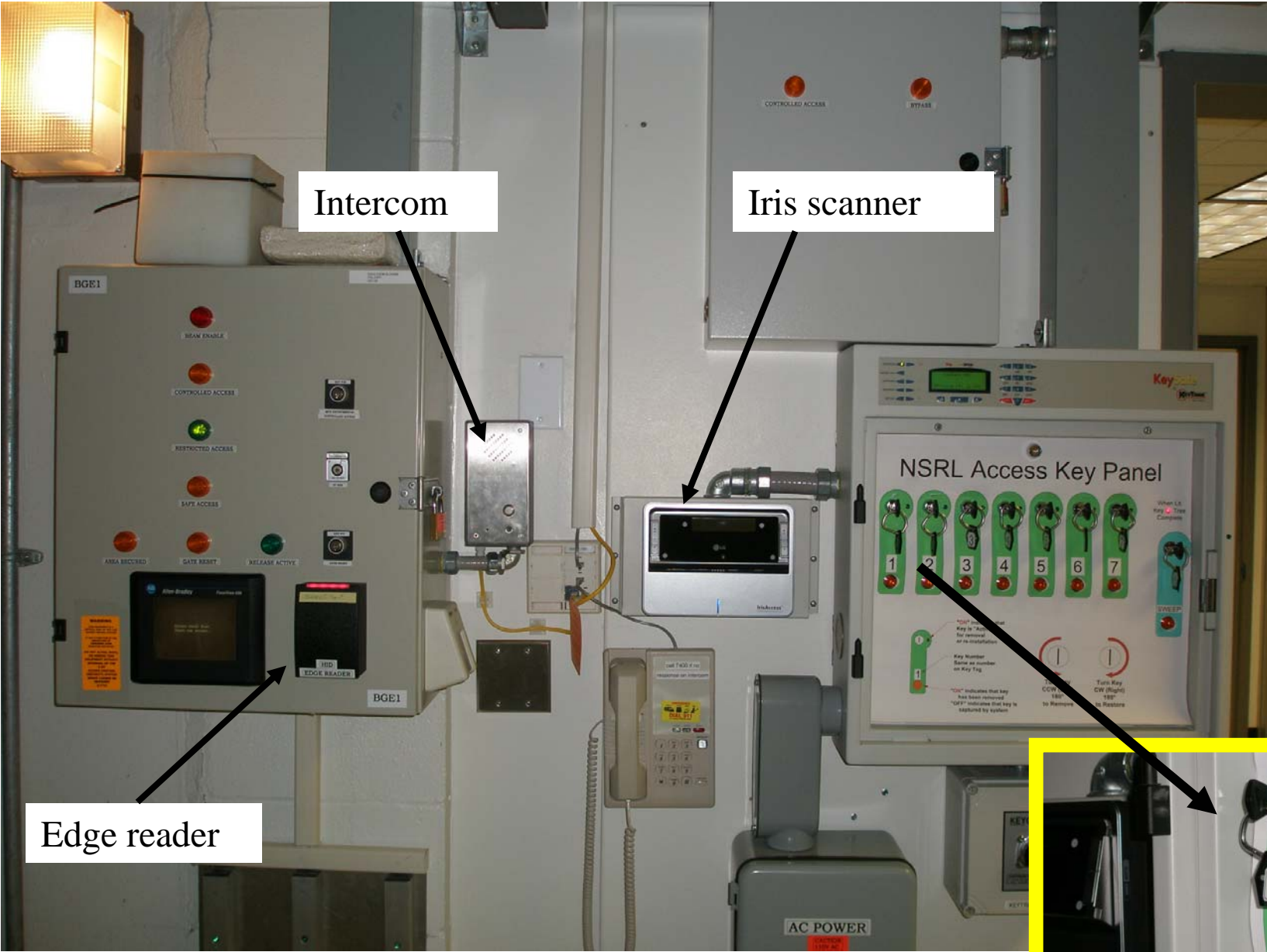
ACCESS PROHIBITED

CONTROLLED ACCESS

RESTRICTED ACCESS



The doors will be posted



Intercom

Iris scanner

Edge reader



Posting on target room door



RADIOACTIVE MATERIALS AREA

ACTIVATION CHECK REQUIRED

This posting means you must not release items from the area without checking for activation.

Contact a Radiological Control Technician (RCT) to perform activation check. An RCT is typically located at NSRL Bldg 958 during experimental runs.

Access Control Modes - Summary

Green Light - RESTRICTED ACCESS

At NSRL: Use orange card-key for entry
(use 256 key if at AGS Bldg 912)

Yellow Light - CONTROLLED ACCESS

- MCR controls & monitors access
- Get Key from Key Tree
- To enter:
Call MCR; be observed by video
- To exit:
Call MCR; be observed by video

Red Light - PROHIBITED ACCESS

This mode means that beam is on
or is about to be turned on.

Access is PROHIBITED

Multiple people (up to 5) entering with one opening of the door

Special notes: (essentially the same rules apply)

For entry during Controlled access Mode:

- Each individual still scans their own irises and pulls their own key from the key tree
- Using the intercom, one person contacts MCR to request access
- The person communicating with MCR informs MCR of how many people (up to 5) would like to enter with one opening of the door
- The Operator decides whether or not he or she will allow multiple people to enter. (It is usually allowed, however it is at the discretion of the on-duty Operations Coordinator.)
- Assuming the Operator is allowing multiple people to enter, identify each individual to MCR by giving the name of each individual to the MCR Operator. (This may take a couple of moments so please be patient.)
- One individual presents their RFID tag (attached to the key) to the edge reader to open the access doors
- All individuals (up to 5) may enter while the doors are open

IMPORTANT: Each individual **MUST** still bring their own individual key in with them
(their own key that they took from the Key-Tree by scanning their own irises)

- As a courtesy to the MCR operator watching by video camera, each person should hold up and show their key to the camera while entering. The camera is typically located up high on the wall across from the key tree.

Multiple people (up to 5) entering with one opening of the door

Cont.'d:

For entry during Restricted Access Mode:

- During Restricted Access Mode, more than one person may enter through the door with one opening of the door provided each individual still scans their own access card (orange card) on the card reader key pad and the small green light on the card reader comes on. The required training of each individual must be current.

Beam Imminent Alarm

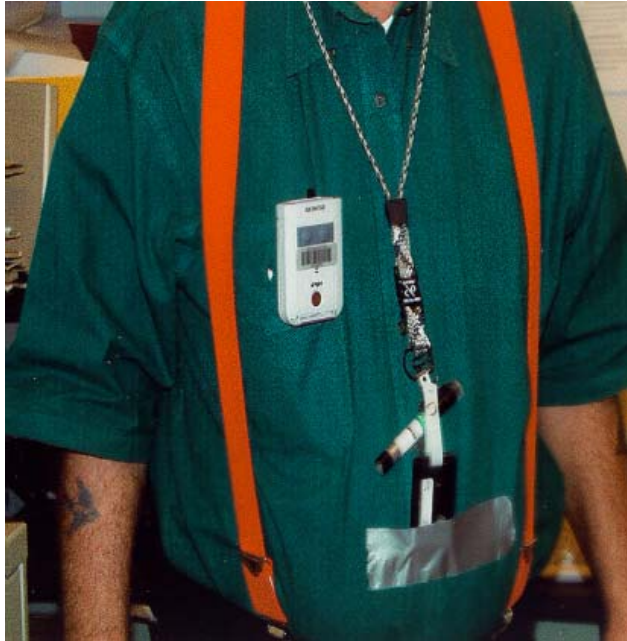


NSRL Target Room (or AGS Bldg 912 Target Rooms)

- **Lights dim**
- **Audible announcement**

ThermoLuminescent Dosimeter (TLD)

Wear TLD on torso between neck and waste.



Return your TLD to a badge location at BNL when not in use; low background area



Your TLD:

- a) monitors your radiation exposure and is your legal record
- b) is exchanged monthly
- c) must be returned to a badge location at BNL when not in use

Radiological Work Permit (RWP)

- RWP not required for access to NSRL support building
- RWP not required for access to NSRL Target room at this time
- RWP REQUIRED for working with Dispersibles (dispersible radioactive material) at NSRL or at Bldg 490
- RWP also required for entry into Radiation Areas or High Radiation Areas.
Several areas throughout C-AD are posted Radiation Area or High Radiation Area.
(example: AGS Bldg 912 slow extraction beam-line (SEB) target rooms)

C-AD Administrative Control Levels (**ACLs**)

Period	C-AD ACLs	Levels allowed on a case-by-case basis with Line Authority Approvals
	(mrem)	(mrem)
Calendar Year	1000	1000 to 1250 (with C-AD Chair Approval) 1250 to 2000 (with Lab Director Approval)
Daily	100	100 to 200 (approval will be on RWP)

C-AD Escort Policy

Contact the C-AD ESHQ Division:

John Maraviglia (x7343)

or

Ray Karol (x5272)

or

Asher Etkin (x4006)

Working with Benchtop Dispersibles

Satisfactory completion of this course as well as an On-the-Job Training (OJT) demonstration with the Facility Support Representative will provide limited qualification to perform dispersibles work at NSRL and Bldg 490.

The dispersibles work will be conducted in properly posted areas under the control of a Job-Specific Radiological Work Permit (RWP) and RCT coverage.

The dispersible work is limited only to sample activity associated with beam irradiation. Dispersible work with samples radio-labeled prior to irradiation requires the full BNL Benchtop/Dispersibles Course (BNL Course # HP-RWT-500).

This training does not qualify you to work with dispersibles at any other facility at BNL.

Note: Opening the container top to allow CO² to enter the sample container while in the incubator does not constitute work with dispersibles.

Contamination Control Work Habits

(for those qualified and working with dispersibles)

- Use absorbent materials in hoods when working with liquids
- Hold absorbents under samples while transporting from primary area to work area
- Frequently survey work area
- Establish a small trash receptacle on the benchtop to minimize the transfer of contaminated materials across the work space
- Housekeeping: store excess materials outside of the work area
- Self-frisk

Note: If you encounter contamination on skin or clothing > 100 counts per minute above background on a GM “Frisker”, stop work, place work area in a safe condition, notify others in the work area, and **notify a C-AD Radiological Control Technician (RCT)**. An RCT is typically located at NSRL BLDG 958 during experimental runs.



Contamination

The following are examples of materials that would be a radioactive contamination concern if the material were to become dispersed:

- accidental spill of liquid biological target material after irradiation
- small pieces of broken or disintegrated beam line instrumentation or target material
- the contents of fire extinguishers or gas cylinders that reside in primary areas during beam operations

Carbon Dioxide (CO₂) Use at NSRL Cell Labs

Carbon Dioxide (CO₂) is used in the cell laboratories at NSRL. Primarily it is used in the operation of the cell incubators.

Carbon dioxide gas is colorless and odorless. It will not burn. It can displace oxygen in air; it may accumulate in low areas. Carbon dioxide is a very mild central nervous system depressant.

In the cell labs there are carbon dioxide monitors. These monitors contain a digital display indicating the CO₂ concentration in the atmosphere. There is also an audible alarm and red flashing light when the CO₂ levels exceed 3000 ppm. NOTE: This concentration of CO₂ does not present a health concern.

In the event that the CO₂ alarm sounds

- IF THE YELLOW LIGHT GOES ON: Check all gas fittings for leaks and for broken connections.
- IF THE RED LIGHT GOES ON: Turn off all CO₂ bottles, leave the cell lab and advise workers in the other cell labs to evacuate. Go to the main entrance and contact the Liaison Physicist (Adam Rusek or Michael Sivertz) or telephone the Main Control Room (extension 4662) to have Dave Phillips contacted.
- DO NOT ENTER THE CELL LABS UNTIL YOU RECEIVE INSTRUCTIONS FROM DAVE PHILLIPS.

Price-Anderson Amendments Act (PAAA)

Failure to comply with safety rules (both radiological and non-radiological), or failure to identify and report non-compliances to DOE, subjects the Laboratory to enforcement action.

Worker Responsibilities include:

- Comply with requirements
- Report non-compliances
- Obey Stop Work Orders

WARNING

Willful or flagrant disregard of safety requirements may result in disciplinary and enforcement action.

Work Plan & Experiment Reviews

Screening for ES&H hazards

Experimental runs are screened for ES&H hazards. Users must **Read & Sign** a work plan document prepared for the specific experimental run. Information about the work plan document may be obtained from your:

Experiment Spokesperson, or
C-AD Liaison Physicist

Experiment Reviews –

All experiments and experimental support equipment must be reviewed by the C-AD Experimental Safety Review Committee (ESRC). It is extremely important that once approved, an experiment may not be changed or added-to without re-review and approval. If you have questions, contact the:

Liaison Physicist,
Liaison Engineer, or
ESRC Chairperson.

Unplanned changes or additions may result in last minute delays for review and approval.

Any material placed in or near the primary beam needs to be reviewed by the ESRC and the ALARA Committees for gaseous or particulate releases that could contaminate the area, equipment or personnel, and must be reviewed for potential overheating.

Radiation Barriers

When are you permitted to climb over or defeat barriers?

NEVER

Electrical Safety

This training does **not** allow you to work on energized equipment, or any electrical circuits that are powered through circuit breakers, disconnect switches and/or fuses, even if the circuits are de-energized.

Electrical equipment must be de-energized and LOTO'd (Locked Out and Tagged Out) in order for qualified and authorized personnel to perform work on them. In some rare circumstances, and in accordance with strict procedures, it may be necessary and permitted to work on, or test, equipment while energized.

All workers performing LOTO or other electrical work must have the appropriate BNL & C-AD training, and C-AD authorization.

Even to operate circuit breakers or disconnect switches, additional training is required. Personal Protective Equipment (PPE) is also required.

Consult with your Liaison Physicist for details if you may need to perform electrical work.

We must comply with NFPA, OSHA and DOE rules (10CFR851).

LOTO: Lockout/Tagout

Used for Personnel Protection

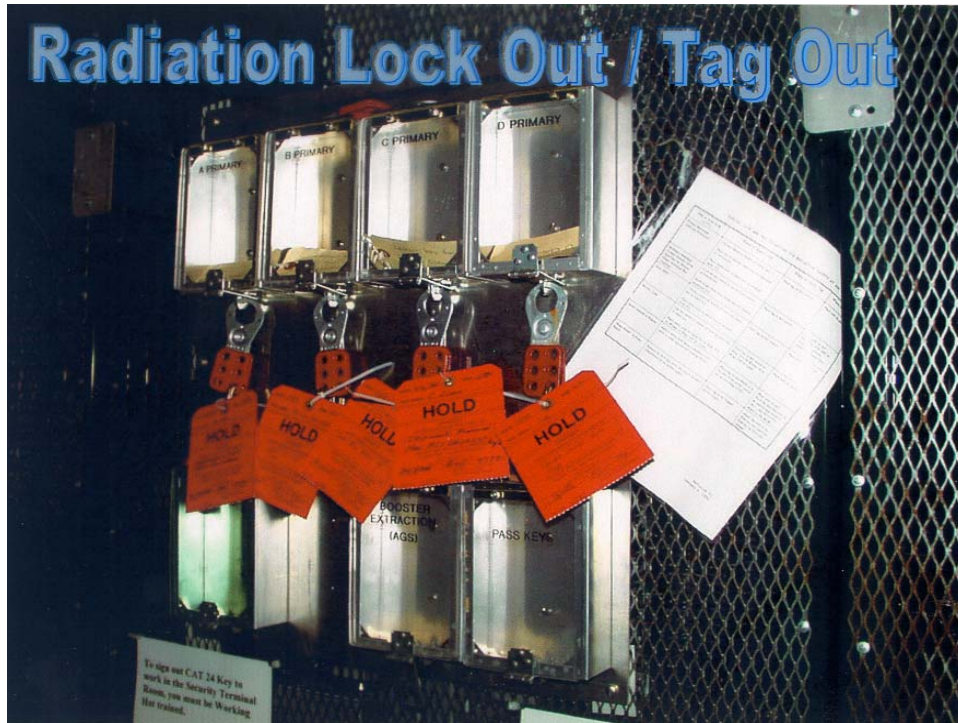


Typical LOTO Lock

A photograph of a red LOTO tag. At the top, it has a hole for a lock. Below the hole, it says 'TAG NO. 66731'. There are fields for 'DATE', 'TIME', and 'APPARATUS'. The main body of the tag is red with 'HOLD DANGER' in large black letters. Below this, it says 'WRITE REASON IN SPACE BELOW' and has a large white box for writing. Further down, it says 'DO NOT USE, MOVE OR OPERATE WHILE THIS TAG IS ATTACHED'. Below that, it says 'TAG ATTACHED BY AND MAY BE REMOVED ONLY BY' and has three boxes for 'PRINT NAME', 'DEPT.', and 'EXTENSION'. It then says 'RETURN TAG TO ISSUING OFFICE WHEN NO LONGER REQUIRED'. At the bottom, it has fields for 'TAG NO. 66731', 'DATE', 'HAS BEEN ATTACHED TO', 'BECAUSE', 'SIGNED', and 'RETURN STUB TO ISSUING OFFICE'. The bottom left corner has 'BNL F 2791A'.

Typical LOTO RED Tag

Radiation Safety (RS) LOTO



Access Control System Equipment (Orange tag)



Do not touch tagged equipment. Contact MCR.

CHIPMUNKS: Area Radiation Monitors



Data is stored and can be used to estimate dose

INTERLOCKS
(will “turn beam off”)
at high dose

Set up like a street traffic light:

GREEN blinking light or analog display:	< approx 2 mrem/hr
YELLOW blinking light or analog display:	> approx 2 mrem/hr
RED blinking light or analog display:	> approx 20 mrem/hr

Transport of Rad Materials

Radioactive materials transferred between C-AD and Medical or Biology must be transported in government vehicles.

Radioactive materials leaving the building shall be tagged as Radioactive Material (RAM) by a RCT.

IF YOU ARE SHIPPING MATERIALS FROM C-A TO OFF SITE, THEN ASK YOURSELF THESE QUESTIONS

IS THE ITEM RADIOACTIVE ?

To check if items are radioactive contact Health Physics x4660. A Radiological Control Technician is also typically located at NSRL during run periods and can check items. Radioactive Materials must be shipped through the BNL *Isotope and Special Materials Group* x 5223.

DOES THE ITEM CONTAIN HAZARDOUS MATERIAL?

Contact C-AD Environmental Coordinator x 7520. Hazardous materials must be shipped through the BNL *Hazardous Waste Management Group* or *Supply and Material Group* .

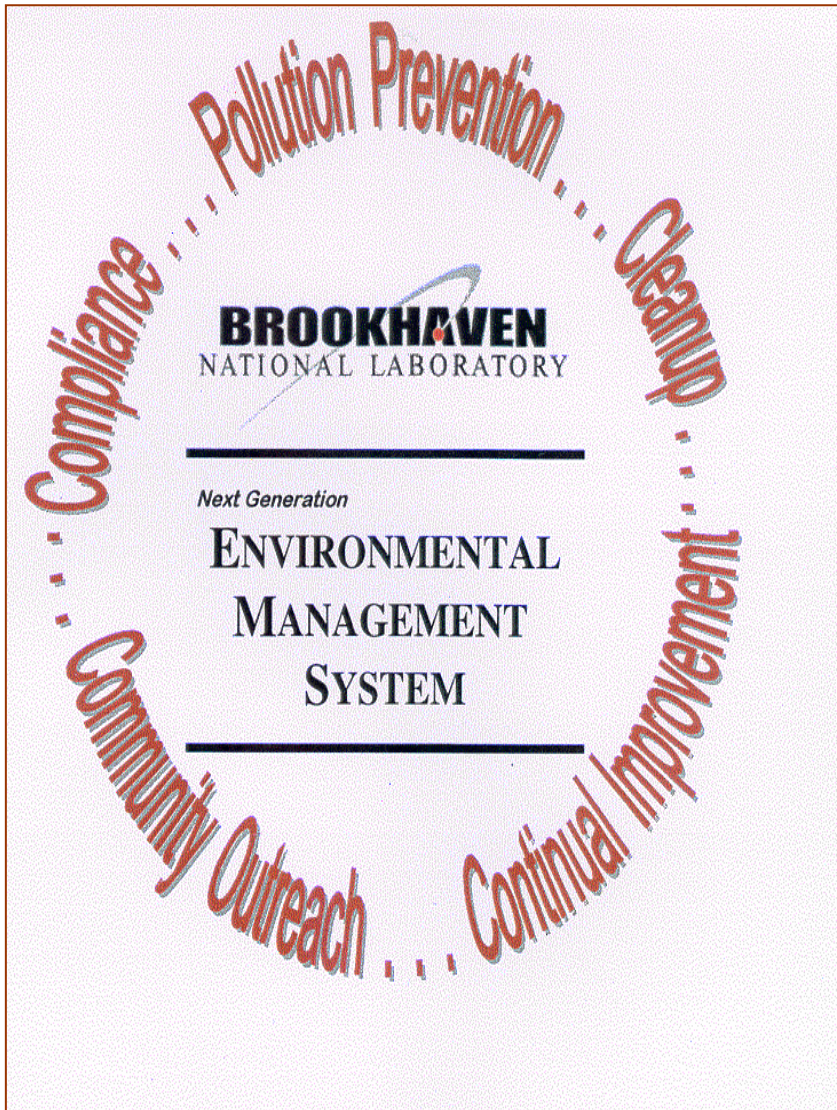
DOES THE ITEM CONTAIN BIOLOGICAL MATERIALS?

Contact Experimental Spokesperson Peter Guida
(Backup contact: Bob Colichio x8440)

Still Unsure? Then contact:

Liaison Physicist Adam Rusek x 5830

Waste Disposal



Improper disposal of radioactive or hazardous waste may result in fines, criminal prosecution, and facility shutdown.

- Contact the C-A Environmental Coordinator (x7520) for information on any waste.
- Contact the C-AD Environmental Compliance Representative (ECR x2905) prior to establishing any airborne, liquid, or solid radioactive or hazardous waste stream.

Note: All medical waste is the responsibility of the Experimenter to have it brought back to the Medical Department.

Spill Reporting

- The C-A Department is required to report spills:
 - to organizations internal to BNL,
 - to organizations external to BNL
 - or both
- C-AD must report *quickly* to external agencies on spills that impact the environment.
- Even minor events, such as spilling any amount of oil in an outdoor area, require reporting.
- If you spill any hazardous or industrial material outdoors on the ground, or anywhere inside and the spill is beyond your control, call x2222 or 911 to report the spill.
Then call:
C-AD Main Control Room (x4662), the C-AD ESHQ Division Head (x5272) or the C-AD Environmental Coordinator (x7520).
- For any spill, notify your Experiment Spokesperson and/or your Liaison Physicist.
- Do not leave a message on an answering machine as notification.
- When reporting, give your name and information on the spill location, type of material and approximate amount.

Workers (You, Guests, Visiting Scientists, and Contractors)



All chemicals used in experimental areas must be approved by the C-AD ESH Coordinator (x5940 or x7200).

Chemicals are to be properly stored and disposed of.

Use of Controlled Substances must be approved by the Experimental Spokesperson

Question: When/how may you bring chemicals to C-AD experimental areas?

Answer: by notifying your Experiment Spokesperson before you arrive at BNL.

Material Safety Data Sheets - MSDS

- Name of Chemical
- Manufacturer
- Hazardous Ingredients
- Physical Characteristics
- Fire and Explosion Data
- Reactivity Data
- Health Hazard Data
- Safe Handling Data
- Safety Control Measures

Available from the C-AD ES&H Coordinator

Compressed Gas Cylinder Handling

Note: Additional training would be required (a web-based course) if you needed to work with compressed gas

Some General Rules:

- Do not drop cylinders or permit them to violently strike each other
- Do not roll cylinders in a horizontal position
- Do not drag cylinders
- Do not handle cylinders with oily hands or gloves (This is especially important when handling oxygen and other oxidizers)
- If hoisting is necessary, use a suitable cradle or platform
- Do not lift cylinder by its cap
- Keep cylinder caps on the cylinder whenever they are not in use
- Transport cylinders using a cart or hand truck designed for that purpose

LEAD

If you need to work with lead, then Contact the C-AD ESH Coordinator

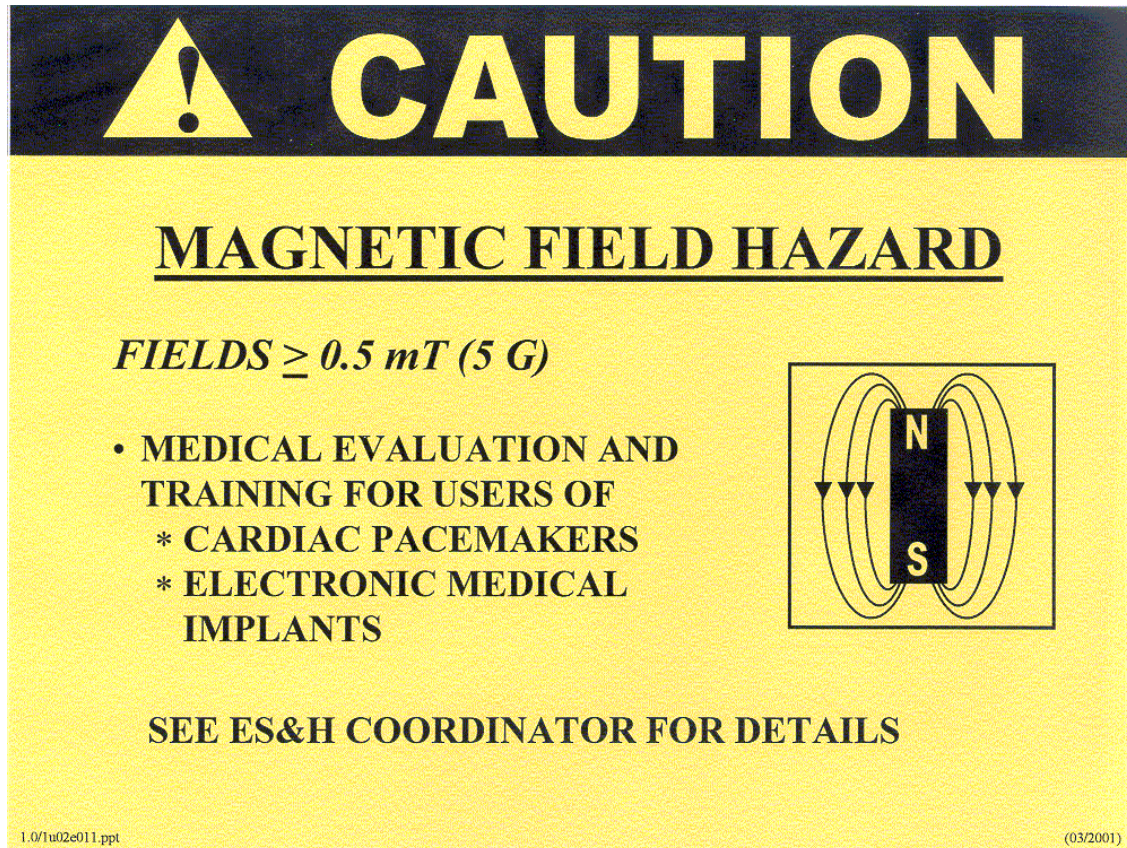
- **No handling of the bare metal**
- **Use Gloves**
- **Use Safety Shoes**



Magnetic Field Hazards

A typical posting at Bldg 912 and elsewhere at C-AD is shown below.

However, the NSRL Target Room is not posted for magnetic field hazard.



Cardiac pacemaker wearers
(or users of other medical
electronic devices)
can not be exposed to fields
greater than 5 gauss.

Emergency (Injury / Illness)

If there is an emergency such as an illness or injury, pull a fire alarm pull-box (if one is in the area) and call 911 or 2222.

From a cell phone: 344-2222 (area code is 631).

For a minor non-emergency injury, report as soon as possible to the BNL Occupational Medicine Clinic (OMC), located in building 490.



Please note the following lesson learned from an arc flash injury at the STAR Experimental Area. This is not intended to imply any fault with the C-AD staff who participated in the emergency and acted as best as they saw fit at the time.

Unless an injury is very minor:

- **Never** transport the injured person to the Clinic yourself; wait for the Fire/Rescue Department to arrive with the EMT and ambulance. Make sure you pull the Fire Alarm box (if one is in the area) to immediately let Fire/Rescue know the location of the problem. Still follow up immediately with a call to 2222 or 911 (on a cell phone: 344-2222) to let F/R know it is an injury so the EMT/ambulance are dispatched to the scene (they usually don't send the ambulance for a fire only).
- If you transport the person yourself, time may be wasted in having the ambulance track you down.
- In addition, you may be stuck with an injured person who passes out or stops breathing, etc., on the way to the Clinic or you could be nervous and have an accident on the way to the Clinic.

Alarm Signals

Response to Continuous or Intermittent Fire Bell

(metal “clanging” type bell)

- Exit the area, report to the outdoor assembly area

Response to Beam Immanent Signal

(lights dim or go out, along with an audible announcement)

- If in the Primary Area ... Push crash button or exit through access gate; contact MCR

Do Not Reenter buildings/areas. Wait for further instructions from Fire Captain or ES&H Coordinator.

ASSEMBLY AREAS

Yellow Posting

EMERGENCY INFORMATION

YOU ARE IN BUILDING # 911

EVACUATION ZONE # 8

IN THE EVENT THE BUILDING ALARM SOUNDS - PROCEED TO
OUTDOOR ASSEMBLY AREA East Parking Lot

IN THE EVENT THE STEADY SITE SIRENS SOUNDS - PROCEED TO
INDOOR ASSEMBLY AREA Main Lobby / Snyder Seminar
room.

SHELTER-IN-PLACE AREA Snyder Seminar Room.

LOCAL EMERGENCY COORDINATOR

A. Piper

EXTENSION 7934

For NSRL:

Outdoor assembly area is
the LINAC parking area

Note Your Surroundings

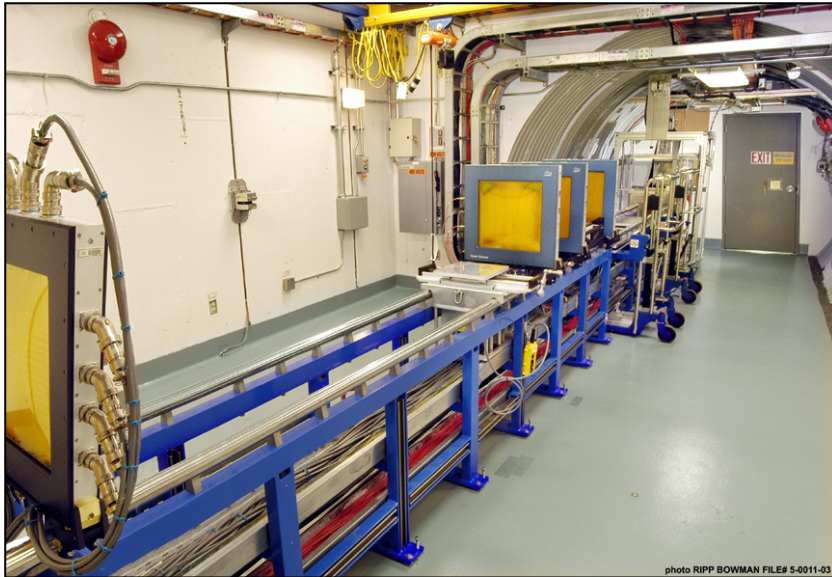
- Exits
- Fire Alarm Pull Boxes
- Intercoms / Telephones
- Crash buttons / crash bars on doors
- TLD Requirements
- Conventional and Radiological Safety Hazards
- Safety Equipment
- Assembly Areas

STAFFING LEVELS AND SAFETY

Rules shall be followed even when you are short-handed. Do not violate safety rules to get the job done. Do not use a procedure or perform activities that you have not been trained on or are not qualified to do, although you feel it will please your supervisor. In short, there are no economics for safety.



Miscellaneous photos



Miscellaneous photos



Edge reader



Approach to doors
from inside



Chipmunk location # 72
at NSRL